GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION
SPONSORED PROJECT INITIATION

Date: October 31, 1979

Project Title: Investigation of Corrosion Problem at Queen Carpet Corporation

Project No: A-2502

Project Director: Dr. C.J. Ray

Sponsor: Queen Carpet Corporation; Dalton, Georgia 30720

Agreement Period: From 10/4/79 Until 12/31/79

Type Agreement: Letter dated 10/4/79

Amount: Not to exceed $895.88

Reports Required: Evaluation Report

Sponsor Contact Person (s):

Technical Matters	Contractual Matters (thru OCA)
Mr. David Wright, Plant Supervisor Queen Carpet Corporation P.O. Box 1527 Dalton, Georgia 30720 (404) 277-1900 Telex-54-3435 WATS 800-241-4031	

Defense Priority Rating: None

Assigned to: CMSL/MSD (~~School~~/Laboratory)

COPIES TO:

- Project Director
- Division Chief (EES)
- School/Laboratory Director
- Dean/Director—EES
- Accounting Office
- Procurement Office
- Security Coordinator (OCA)
- Reports Coordinator (OCA)
- Library, Technical Reports Section
- EES Information Office
- EES Reports & Procedures
- Project File (OCA)
- Project Code (GTRI)
- Other

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION

Date: April 7, 1980

Project Title: Investigation of Corrosion Problem at Queen Carpet Corporation

Project No: A-2502

Project Director: Dr. C. J. Ray

Sponsor: Queen Carpet Corporation ; Dalton, Georgia 30720

Effective Termination Date: December 31, 1979

Clearance of Accounting Charges: December 31, 1979

Grant/Contract Closeout Actions Remaining:

- x Final Invoice and Closing Documents
- _ Final Fiscal Report
- _ Final Report of Inventions
- _ Govt. Property Inventory & Related Certificate
- _ Classified Material Certificate
- _ Other _____

Assigned to: CMSL/MSD (School/Laboratory)

COPIES TO:

- Project Director
- Division Chief (EES)
- School/Laboratory Director
- Dean/Director–EES
- Accounting Office
- Procurement Office
- Security Coordinator (OCA)
- Reports Coordinator (OCA)
- Library, Technical Reports Section
- EES Information Office
- Project File (OCA)
- Project Code (GTRI)
- Other _____

CA–4 (1/79)

A-2502

GTEES ENGINEERING EXPERIMENT STATION
GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

February 22, 1980

David Wright
Plant Supervisor
Queen Carpet Corporation
P. O. Box 1527
Dalton, Georgia 30720

Dear David:

This letter serves as the final report covering the brief investigation of the ceiling corrosion problem in your plant. The project number and title is A-2502, "Investigation of Corrosion Problem at Queen Carpet Corporation".

Problem Statement

After about one year of service, the ceiling panels in the vicinity of a Kuster machine (dyes carpet and sets dye) showed visible signs of rusting. The total area affected is increasing in size and the areas initially noted to be corroding are becoming more densely covered with rust.

Background Information

The ceiling panels are ribbed. They were factory coated with a primer of unknown generic type identified only by "universal primer". The white topcoat was applied on the installed ceiling after the Kuster was in operation for approximately two weeks. The topcoat was Sherwin-Williams B85 WA38 Dry Fog, Flat. Apparently paints of this type are used when painting above equipment since overspray dries to an easily removed powder by the time it contacts the ground or equipment below. An epoxy based coating was not used since the overspray falling on equipment would be wet and, upon drying, adhere to the equipment, making clean-up difficult.

Steam is used to set the dyes and the carpet is rinsed with copious amounts of cold water. Exhaust fans and duct work are employed to minimize the amount of steam escaping into the plant. There is open water at the end of the Kuster line with some steam or vapor going into the atmosphere.

Overall, the amount of steam escaping is small. There was a two week period during which steam was not vented directly from the dyeing line due to equipment malfunction. The corrosion of the ceiling panels, however, preceeded this.

Observations

On the basis of two site visits (August 31 and November 20, 1979), the following observations are made:

1. Rust is predominately on the ribs of the ceiling panels.
2. Droplets of condensed water were observed on the ribs (first visit).
3. Sensation of higher humidity at the end of the dyeing line than in other areas of the plant.
4. Severe localized rust on pipe, which carries cold water, where the pipe is exposed to escaping steam.
5. Severe rust on ceiling directly above a valve that had broken, venting steam directly on the ceiling panel.
6. Film thickness (total) was measured as ~ 6-10 mils on ribs and flat sections of the panels.
7. Pinhole analysis - inconclusive.
8. Underfilm rusting severe enough to rupture the coating.
9. Steel around the end of the dyeing line where water stands and some steam is observed is generally free of rust; painted with an epoxy paint obtained at local hardware store and applied by Queen Carpet personnel.
10. Contamination by sulfamic acid carried by steam unknown.
11. The service life of the paint expected to be 2-3 years.

Conclusions

The corrosion is caused by the high moisture conditions that occur in the plant, especially in the vicinity of the Kuster. High humidity conditions do not have to exist continuously for corrosion to occur; periods of time in which condensation occurs are sufficient to saturate the film and interface so that corrosion will commence. Once started, the film is more susceptible to corrosion because of the hydroscopic nature of rust and film undercutting, blistering, and rupture as corrosion product is accumulated. The rusting will not stop but only get worse as is already evident (despite the contractor's claim that it will stop).

The paint system, quite obviously, is not of a quality to withstand the environmental conditions found in the plant even though its thickness is in the range commonly recommended for maintenance duty. The thickness may be misleading though since the quick dry characteristic limits film coalescence. The top layer of the "Dry Fog" paint was found to be powdery and easily removed. Hence, the film structure may be very porous, allowing moisture easy access to the primer layer whose thickness is not known.

Recommendations

The rusting will not stop; in fact, the rate of rust development can be expected to accelerate. The ceiling panels need to be repainted.

For repainting, two schemes are proffered. In either case, the old paint has to be removed in those areas showing rust. The use of rust converters to spot treat and repaint affected areas is too risky and one can only expect limited service life. The first scheme is to have a painting contractor clean and repaint the ceiling with a different coating system. The second scheme calls for people from the maintenance crew to do the job on a relatively small section-by-section basis. Both will require that a canopy or tent be constructed around the Kuster to minimize exposure by overspray from the cleaning and painting operation and to minimize or avoid down-time.

A specific recommendation for a coating system cannot be made but a selection process can be:

1. Have potential contractors supply coated panels of their recommended system or systems; the panels should be of the same steel used in the ceiling panels now and given the same surface preparation to be used at the job site.

2. Test the coated panels in 100% relative humidity conditions, evaluating them for resistance to blistering, rust, and loss of adhesion.

3. Perform the testing at several different film thickness values to yield information to be included in the specifications as to minimum film thickness acceptable for the actual job.

I hope the above analysis is helpful in resolving the corrosion problem. If you have any questions, please do not hesitate to call. Again, my number is 424-9651.

Sincerely,

Charles Ray
Material Sciences Branch
Chemical & Material Sciences Laboratory

CR:gp

cc: W. C. Darley, IED/EEL